CSCI 49390 §01 #52765 and CSCI 79531 §01#52766
Spring 2024

Eric Schweitzer

August, 2024

Text: There is no text book, but there will be papers to read. They will be linked from the web page below.

Web: Useful links, including an updated version of this syllabus, links to various papers and all the home work assignments will be available on `http://www.cs.hunter.cuny.edu/~eschweit/`

Finding your Professor: I can be reached to make appointments etc. by contacting me before or after class, by phoning my office at (212)772-4349, by stopping up at my office (N-1000E) during scheduled office hours (Mondays and Thursdays 2:00-3:00) or any other time I'm there and not otherwise engaged, or (by far the best way) by sending me e-mail at eric.schweitzer@hunter.cuny.edu. Please note that I will only read plain `ASCII text` email, not HTML or MicroSoft Word encoded documents. Also note that any email concerning anything that might fall under the FERPA regulations (e.g. questions about grades or other class related issues) *must* be sent from your "myhunter" account.

In addition, messages can be left for me at the Computer Science Department office, which is located in N-1008 and is reachable at (212)772-5213.

49390 Grades: Will there be an exam, a major project and a paper describing the project.

- The exam will be given on Monday November 25. It is worth 45% of your final grade.
- The paper and project are due no later than the scheduled final exam period. This is currently Wednesday, December 18 from 5:20 to 7:20 pm however the College may change this schedule.
- The project must involve some kind of non-(electronic digital) computation. We will discuss this further as the semester progresses. This will be 40% of your grade.
- The paper, worth the remaining 15% of your grade, is about your project. It should describe what your project does and how it does it. You are encouraged to to use LaTeXto create it the paper. More details will follow.

79531 Grades: Similar to the above, there will there be an exam and a major project. There will be two papers.

- The exam will be given on Monday November 25. It is worth 45% of your final grade.

- There will be one paper, worth 10% of your grade, that is a "literature search". Topics can include just about anything germane to the class. You must use LaTeXto create this paper, and MLA in-text citations and a reference list to document it.
- The second paper and project are due no later than the scheduled final exam period. This is currently Wednesday, December 18 from 5:20 to 7:20 pm however the College may change this schedule.
- The project must involve some kind of non-(electronic digital) computation. We will discuss this further as the semester progresses. This will be 35% of your grade.
- This "second" paper, worth the remaining 10% of your grade, is about your project. It should describe what your project does and how it does it. You must use LaTeXto create it the paper. More details will follow.

I do not give "extra credit" assignments. Do not expect to be able to pull up your grade by doing additional work.

Topics, Goals or Outcomes: This is a strange concoction of a "theory" course and a programming course. To succeed, you will have to understand some abstract concepts (*Th(*$\mathbb{N}$*)* and *Th(*$\mathbb{R}$*)*, DNA, etc.), as well as practical issues like interfacing analog to digital systems.

This course supports departmental learning outcomes 1B, and 1C by exposing the student to the differences between computation over the Natural numbers and over the Real numbers, and how that relates to differences in analog and digital computation. In addition it supports outcome 3A by requiring students to communicate what they have learned about this strange and confusing subject.

We will not try to hew the order of topics below, but plan to spend a total amount of time as indicated on the topics indicated:

Weeks	Topic
2	Intro, review, limits of digital computing, theories of $\mathbb{N}$ and $\mathbb{R}$
1	Physics, Philosophy, Calculus and ODEs
1	Biology and related computers (DNA based, neuron based neural nets)
1	Mechanical analog computing (slide rules, integrators, planimeters, differential analyzers, etc.)
1	Mechanical digital computers (abaci, Turing Tumble, pneumatic, fluidic, etc.)
8	Analog electronics, The Analog Thing (THAT), "programming" and interfacing THAT to a digital computer

Credit Where Due This class could not have happened without the support of the late William Sakas who, as Chair, managed to convince the School to buy THATs. Your lives have been made much easier by Ken Prakasam, who designed and programmed the analog to digital bridge we will be using and wrote the display software we will be starting with. His GutHub repository is `https://github.com/Nobel-Ken` and we will be using material at `https://github.com/Nobel-Ken/thatBridge`.

Academic Integrity Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

Policy on Bullying: Bullying, cyberbullying, online hate, intimidation, threats, harassment, and pressure to share schoolwork are all forms of violence. CUNY holds a zero tolerance stance towards all such acts. The University is committed to prevention of any form of bullying, will respond promptly to threats and/or acts, and will protect victims of bullying from retaliation. As a criminal matter, the New York Attorney General defines cyberbullying as the use of email, websites, instant messaging, chat rooms, text messaging and digital cameras to antagonize and intimidate others. Disrupting a teleconferencing platform (such as Zoom/Skype/Blackboard Collaborate Ultra) is a federal crime.

ADA Compliance In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical, and/or Learning) consult the Office of AccessABILITY, located in Room E1214B, to secure necessary academic accommodations. For further information and assistance, please call: 212-772-4857 or 212-650-3230.

Personal Protective Equipment and other COVID matters: Whatever rules CUNY or Hunter put in place will be enforced. Remember that these rules can change with little warning.

Hunter College Policy on Sexual Misconduct In compliance with the CUNY Policy on Sexual Misconduct, Hunter College reaffirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationships. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.
a. Sexual Violence: Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444).
b. All Other Forms of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose (jtrose@hunter.cuny.edu or 212-650-3262) or Colleen Barry (colleen.barry@hunter.cuny.edu or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Hunter East 1123. CUNY Policy on Sexual Misconduct Link:
`http://www.cuny.edu/about/administration/offices/la/Policy-on-Sexual-Misconduct-12-1-14-with-links.pdf`

Cell Phones etc. I expect all cell phones, pagers, etc. to be inaudible during class. I expect laptops and other electronic devices, if used, to be used only for class related activities. Activities not related to class include but are not limited to facebook, twitter, other social networking web sites, "surfing", email, mu*s, hulu, southparkstudios, etc. Any student with an electronic device that disrupts the class will lose two (2) points from their final average (per occurrence).

Note that details of this document are subject to change if the need arises.

The current, corrected, updated syllabus, with active URL links is here.

The thatBridge, your gift from Ken, is here. The code required is all zipped up here, and instructions for programming the bridge is here
Much information about THAT is here.
A wiring template for the THAT is here

Wikipedia has a nice article on the Pascaline and here is an animation of the inner workings.

Of the many papers you'll want to read you should try "Sketch of The Analytical Engine Invented by Charles Babbage" by Ada Augusta, Countess of Lovelace. Babbage never built the Analytical Engine, but what could have been is described by Sydney Padua's video, and "computerphile" has one as well. A detailed look at the Difference Engine, which he did build parts of, is demonstrated here

Curta Calculators are Cool! See curta.org for an overview. Simulators are available too, like a 2D and a 3D simulator.

The Turing Tumble is another (theoretically) Turing Complete mechanical computer done with marbles.
Simulators are available like this and this.
You can also find "excercises" to do ("programs" to "write") for the Turing Tumble, with solutions, here.

There is a 4 part series on michaelson's harmonic analyzer and '100 year old computer' (as in "michaelson-morley"):
Part 1: Intro
Part 2: Synthisis
Part 3: Analysis
Part 4: Operation

Complicated but plain complex plane pictures with fourier series:
See this one from 3blue1brown, from 0:45 to 2:09, and this from SmarterEveryDay, from 5:00 to 6:50.

Water and wind compute too! There are both analog and digital fluidic and pnumatic computers. Steve Mould has a digital water computer on youtube Better, and more applicable to us (but not detailed enough) pneumatics as a front end

Use a virtual slide rule! See The Slide Rule Museum's Virtual Slide Rule Simulators

Antikythra: Was this the first analog calculator? Follow this link for a 30 minute overview , this one for a 6 hour build using tech available at the time, and many other videos about this wonderous machine.

More about planimeters than you want to know (but less than you should know) are here: One with little math and another with lots of math

Biological computing: The most accessable (doesn't require 4 years of graduate work in psychology or biology) is on YouTube: Dr. Steve M Potter at MIT has been at it for years. This is 15 years old, but a good place to start. Some folks are teaching neurons to play games like pong and DOOM. You can put neurons in robots like this. Should one worry about morality? Are these things concious? Maybe.